XIV.

INJURIOUS INSECTS AND OTHER ANIMALS OBSERVED IN IRELAND DURING THE YEAR 1904.

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(PLATES XXIII.–XXVI.)

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CORN INSECTS.

Crane-Flies.

Tipula oleracea, Linn., and other species.

THE destructive "Leather-jacket" grubs of these flies continue to attract notice by their ravages in the roots of cereals. In the month of May I was informed that a whole field of Oats at Sutton, County Dublin, had been ploughed up on account of the irreparable injury done by these grubs. I further received numerous specimens from County Derry, where they had also been injurious to Oats.

A description of the life-history of these insects, with notes on the means which have been suggested for preventing and checking their ravages, may be found in my previous papers (3, 1902–3). During the past year a leaflet (No. 51) on the subject was issued by the Department of Agriculture and Technical Instruction. This leaflet—besides laying stress on the importance of closely grazing pastures that are to be broken up, clearing away rank growth by rough mowing, and letting a potato crop be grown before an oat crop—states that "the use of agricultural salt applied at the rate of 3 cwt. per statute acre about three weeks before sowing the seed is beneficial, particularly if the young plants be fortified against attack by a suitable mixture of artificial manures." Stress is also laid on effective ploughing—"Bad ploughing very

much favours the attack, particularly when the grass is not properly turned down. In this connexion the Department strongly urge the universal use of ploughs with an effective skim-coulter, when grass-land is ploughed preparatory to sowing Oats." A correspondent in County Derry recommends the application of salt to the lea about two months before ploughing, the salt being worked into the grass-land by chain-harrowing and rolling.

Some laboratory experiments, which I tried during the summer with a large number of the grubs, showed that they succumb rapidly when powdered naphthalene is mixed with the soil, or a very dilute solution of formalin (3 per cent.) applied. It would be desirable to try similar experiments in the field on a large scale. Some insecticides for mixture with the soil are now on sale, and might prove effectual against Crane-fly grubs and other root-feeding insects.

The Frit-Fly.

Oscinis frit (Linn.).

Oats from County Down damaged by the maggots of this fly were recorded in July. An account, with figures of the insect, is to be found in my paper on Injurious Insects observed during 1902 (3, 1902, pp. 147–8).

The Gout-Fly.

Chlorops tæniopus, Meig.

Specimens of Barley infested by the maggots of this fly were sent from Crossabeg, County Wexford, in July. Although a well-known insect, and doubtless widely spread in Ireland, I have not previously received evidence of its ravages in this country. Repeated references to the insect are to be found in Ormerod's "Reports" (9, 1877, 1878, 1879, 1880, 1882, 1885, 1887, 1888, 1889, 1890, 1892, 1893, 1894); and an excellent short account of its life-history has lately been given by Theobald (15, pp. 23–5); while a fuller description may be seen in Ritzema Bos' work (2, pp. 625–8).

Chlorops tæniopus is a small two-winged fly, measuring about 4 mm. ($\frac{1}{6}$ inch) in length and 6 mm. ($\frac{1}{4}$ inch) across the outspread wings. The flies of this genus—all small in size—are characterised by their prevailing black and yellow colouring, the sparse covering of hairs or bristles on the cuticle, the relatively short and broad wings, and the flattened circular shape of the third segment of the feeler (fig. 1, *b*). In *C. tæniopus* the head is yellow, with a central, triangular, black marking, the feelers being entirely black; the fore-body is yellow, with three broad, black, longitudinal stripes above, and a short, narrow stripe on either side, the scutellum being yellow; the hind-body is yellow, with somewhat obscure dark-brown transverse markings; the thighs and shins of the legs are entirely yellow, except that the fore-shins are black-tipped; the fore-feet of the

a *b*

Fig. 1.—(*a*) Gout-fly [*Chlorops tæniopus*, Meig]. Male: × 8. (*b*) Head seen from the side: × 20.

female are entirely dark; those of the male have the basal and two terminal segments dark. The middle and hind feet in both sexes have the three basal segments yellow, and the two terminal segments dark (fig. 1, *a*). The tail-end is rounded in the male, and pointed in the female.

These flies are on the wing late in May or in June. The female lays her eggs (which are elongate, oval, of a creamy-white colour, with a honeycomb-like pattern on the upper surface, and a wide longitudinal groove beneath) singly or in couples, on the outer leaves of young corn-plants, choosing those plants in which the ear

is still completely enveloped by the sheathing-leaves. The young maggot, when hatched from the egg, makes its way beneath the sheathing-leaves to the haulm, which it proceeds to attack. Beginning with the lower part of the ear, or the stalk just beneath, the maggot works its way down a channel towards the first node. The presence of the maggot often stops the growth of the plant, so that the ear remains enclosed within the sheathing-leaves, and the shoot shows a characteristic "gouty" swelling. When the haulm grows to anything like its proper length, the ear is stunted, and the grain comparatively worthless. The fully-grown maggot is 6–7 mm. ($\frac{1}{4}$ inch) in length.

Late in June, or early in July, the maggots pupate; the brown puparium is usually to be found at the bottom of the furrow which the maggot has gnawed down the stem, but occasionally between the sheathing-leaves and the damaged ear. The flies come out during August, September, and October, when they pair and lay their eggs on winter corn or wild grasses. The maggots hatched from these eggs make their way inside the sheathing-leaves, and thence to the summit of the undeveloped shoot, where they pass the winter. The effect of their presence is to reduce the normal length of the stalk, while the base of the plant swells enormously, and the sheathing-leaves become excessively broad. The flies produced from these maggots lay eggs on the Barley and other cereals in spring and early summer, as described above. Thus there are two complete life-cycles in the year (Theobald, 15 ; Ritzema Bos, 2).

The concealed feeding-habits of the maggots render their destruction by insecticides impossible. Nothing can be recommended for an attacked crop except the application of manure to stimulate growth. But our knowledge of the life-history of the fly suggests several practicable methods of prevention. Early-sown corn suffers but little from the summer attacks of this insect, because, before the spring brood of flies appears, the young plants have passed the stage appropriate for egg-laying. Barley badly affected by this pest is always found to have been sown late. On the other hand, when winter corn is grown it should be sown late, so that the autumn brood of flies may find no young plants ready for egg-laying. When no corn is available, the flies lay

on wild grasses; hence grassy headlands should be cut and burnt in winter. Lastly, the refuse from an attacked crop, after threshing and stacking, will probably contain many puparia; such refuse should therefore be gathered and destroyed. The flies can sometimes be collected in numbers from stacked corn.

Millipedes.

Polydesmus complanatus (Linn.).

Complaint was received in May of damage to a field of Newmarket Oats in County Carlow by Millipedes of the genus Polydesmus. It was stated that these creatures began to eat the plants at the ground-level, and then travelled down to the roots. A portion of the field, ploughed at a time different from the remainder, was not injured; probably the ploughing had, in this instance, destroyed the eggs. Theobald (14, pp. 86–7) recommends broadcasting lime over the surface, and working it into the soil, or setting traps in the form of hollowed-out mangolds (potatoes would probably be effective also) wherein the Millipedes can be enticed and destroyed.

Stem Eelworms.

Tylenchus devastatrix, Kühn.

Samples of Oats, showing the characteristic "tulip-root" condition due to the presence of these minute thread-worms, were received from County Down in July. This infestation, which has attracted much attention in Great Britain during the last twenty years, seems to have been but little noticed in Ireland. Many references to the worms are to be found in Ormerod's "Reports" (9, 1886, 1887, 1888, 1889, 1890, 1894, 1896, 1897, 1898), and a full account of them is given by Ritzema Bos (2, pp. 733–760), who has paid special attention to the class Nematoda, to which they belong.

Nematode worms may be readily distinguished by their thick, usually smooth, transparent cuticle, their whitish colour, and the absence of the segmentation and bristles which characterise the Ringed-worms or Annelida. There is a powerful muscular

pharynx and narrow gullet, formed by an inpushing of the body wall with its outer skin and cuticle; this is followed by the flattened intestine, whose walls are without any muscular tissue, ending at the anus situated near the hinder end of the body. The sexes are separate, and the genital organs are long and tubular in form; the vas deferens of the male opens close to the anus; but the vagina of the female is always situated in front of the anus.

The Eelworms, or Anguillulidæ, are a family of Nematodes, distinguished by their very small size, the presence of two swellings in the gullet (fig. 2, *g.*), and of two spicules (fig. 2, B, *sp.*), equal in size, at the male genital opening. The mouth is frequently armed with a horny "dart" (fig. 2, *d.*) by means of which plant-tissues are pierced and nourishment obtained. The eggs produced by members of this family are comparatively fewer in number than among Nematodes generally, but they are of relatively larger size; and as they complete their development rapidly, the rate of multiplication is high. Eelworms live in damp earth, and feed on decaying organic matter, or on living plant-tissues. They do not, like most Nematoda, live as parasites on higher animals.

The genus Tylenchus contains a number of Eelworms in which both sexes are slender and elongate throughout life. (In Heterodera —a species of which, *H. Schaachti*, is very destructive to the roots of Sugar-beet, Tomatoes, and Cucumbers—the female becomes swollen and lemon-shaped.) The mouth is provided with a small, sharp, hollow spine, which swells at its hinder end into a three-lobed knob. The ovary (fig. 2, A, *ov.*) and oviduct (fig. 2, A, *ovd.*) of the female are unpaired, and the vagina (fig. 2, A, *va.*) opens behind the middle of the body. The cloaca of the male has a delicate fold of skin on one or both sides, forming a "bursa" (fig. 2, B, *bu.*).

T. devastatrix is a minute worm, measuring from 1 mm. to 1·5 mm. in length. The tail-region, which is markedly narrowed, is about $\frac{1}{16}$ the length of the body. In the female the ovary and oviduct are unpaired, and the vagina opens usually $\frac{1}{5}$ of the body-length, from the tip of the tail. In the male the bursa may be developed all around the cloaca, or on one side only. The species is excessively common, and is to be found on a great variety of

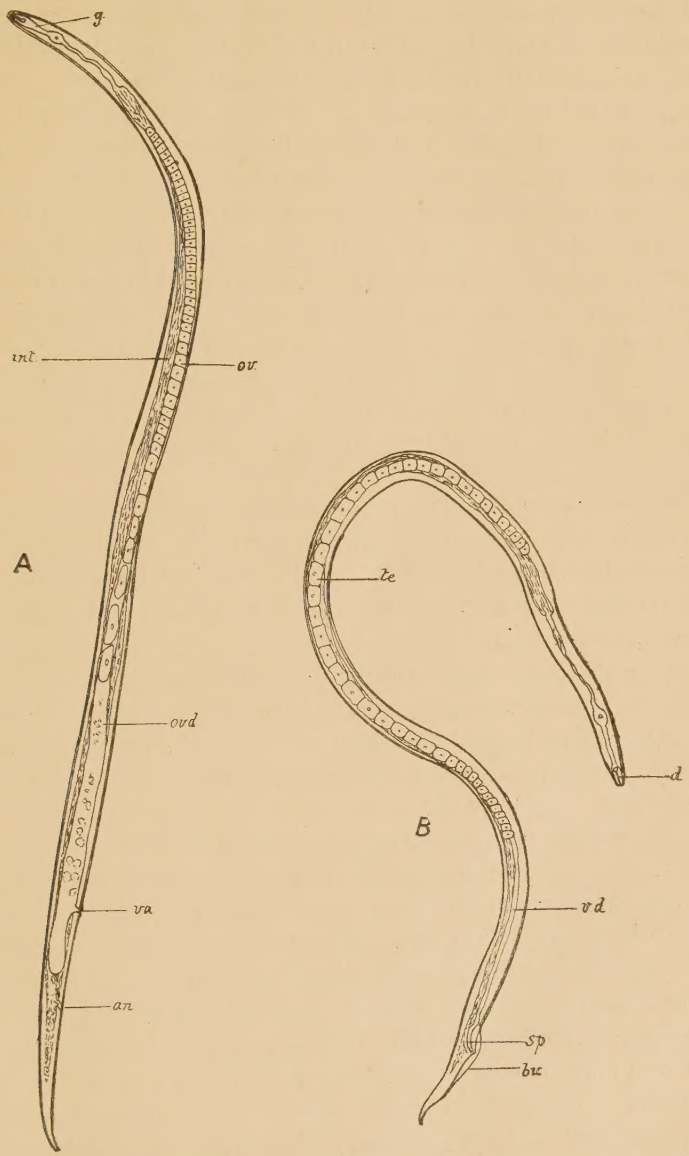

Fig. 2.—Stem Eelworm [*Tylenchus devastatrix*, Kühn]. *A*—Female: × 150. *B*—Male: × 150. *an.* anus; *bu.* bursa; *d.* dart; *g.* gullet; *int.* intestines; *ov.* ovary; *ovd.* oviduct; *te.* testis; *v. d.* vas deferens; *va.* vagina; *sp.* male spicules.

wild and cultivated plants. At different times it has been noticed as injurious to Oats, Rye, Wheat, Clover, Turnips, Hops, Onions, and Hyacinths; in these countries Oats and Clover seem to suffer most severely from its ravages. Ritzema Bos has shown that worms from any particular crop will infest plants of that kind more readily than those of any other kind.

In Oats, when these worms are present, the base of the stem becomes swollen—hence the term "tulip-root"; and stunted and deformed shoots grow around it. The true roots are not attacked, the Eelworms occurring in large numbers within the swollen base of the stem, among the sheathing-leaves surrounding it, and also in the deformed shoots. Their presence leads to an excessive development of the spongy tissue (parenchyma) of the plant, whose cells grow and multiply abnormally, while the growth of the vascular bundles is arrested.

These Eelworms enter young plants, and remain throughout the summer there, feeding and multiplying; several generations succeed one another through the year. When the Oats ripen and become dry, most of the worms leave the plants and go back to the soil, where, in the surface-layers, the young are able to live for more than two years in a state of suspended animation, from which they are temporarily roused when the ground is moistened by rain. Thus the soil is infested after an attacked crop has been reaped; and unless effective measures be taken, the mischief may be carried on from year to year.

The worms cannot live at any great depth below the surface; hence, deep autumn ploughing, with a skim-coulter attached, as recommended above for destroying Crane-fly grubs (p. 282), is an excellent preventive measure for this disease also. In rotation, two crops both subject to the attack of these worms should not succeed each other—for example, Oats and Clover. As a remedial dressing, sulphate of potash, to the amount of 1 cwt. to the acre, has been found effectual; a mixture of sulphate of potash (2 parts), sulphate of ammonia (3 parts), and phosphates (4 parts), applied to the amount of 1½ cwt. to the acre, has also been recommended.

CABBAGE AND TURNIP INSECTS.

The Root-Fly.

Phorbia brassicæ, Bouché.

Cabbages at Glasnevin, County Dublin, were badly attacked in the summer by the maggots of this fly, described somewhat fully by me in a previous paper (3, 1901). Unfortunately the effective methods for preventing the egg-laying of the fly, and for destroying the maggots, have been pronounced uneconomical by Irish farmers; and experiments with the view of finding a practical remedy for this serious pest are badly needed.

MANGOLD INSECTS.

The Mangold-Fly.

Pegomyia betæ (Curtis).

Plates XXIII. and XXIV.

This well-known fly attracted very much attention throughout Ireland during 1904. Complaints of the damage done by its leaf-mining maggots were received from numerous localities, so widely apart as Counties Antrim, Derry, Armagh, Sligo, Kildare, Wicklow, Wexford, and Cork; and the attack was noticed from June until September.

The female fly lays her eggs in clusters, usually of eight or nine, beneath the leaves. The eggs are white, elongate, oval, about 1 mm. in length, and showing a characteristic sculpture on the surface (Plate XXIII., figs. 1, 2). The young maggot, as it is hatched from the egg, makes its way directly into the leaf, and burrows beneath the upper and lower leaf-skins, devouring the soft, green tissue as it goes along. As a number of the maggots grow in size, the mines, at first narrow, are widened out, so that the leaf-surface becomes largely covered with yellow or brown blisters, partially filled with the black excrement of the maggots. Ultimately the leaves droop and fade, so that a mangold-field badly attacked by these insects presents a withered and forlorn aspect. (Plate XXIV.)

From the amount of material sent in by different correspondents, I have been able to study various stages in the development of the maggot. The newly-hatched maggot is 1·4 mm. long (Plate XXIII., fig. 3); its mouth-hooks are comparatively simple, the basal sclerite having the dorsal process single (fig. 3, *a*); each tail-spiracle has a single, rounded opening constricted in the middle (fig. 3, *b*, *c*). At its next stage (fig. 4) the maggot is 2 mm. long, with the mouth-hooks already (fig. 4, *a*) closely resembling those of the full-grown grub (compare figs. 5, *a* and 6, *a*); the tail-spiracle now shows two distinct oval openings (fig. 4, *b*, *c*); at this stage there are some rather prominent spines on the ventral aspect of the third and fourth trunk-segments. When the maggot is 6 mm. long (fig. 5), probably two moults after the 2 mm. stage, these spines are distinctly less prominent; the prothoracic spiracle (fig. 5, *b*) with seven branches is now conspicuous, and the tail spiracle has three openings like that of the adult (fig. 6, *d*). The full-grown maggot (fig. 6) measures from 8 to 10 mm. in length. Its much-wrinkled skin is beset with very minute spines; the tubercles surrounding the tail spiracles are small and inconspicuous (fig. 6, *c*), and each spiracle has three broadly oval openings (fig. 6, *d*). The prothoracic spiracle now possesses from eight to ten branches (fig. 6, *b*). Evidently the maggot resembles closely that of *Pegomyia vicina*, Lintner, described and figured by Howard (4, pp. 50–52).

The maggots appear to pass through their various stages in two or three weeks, the rich nature of their food enabling them to grow rapidly. When fully fed, the larval skin hardens to form the dark-brown, barrel-shaped puparium (fig. 7) which protects the delicate pupa. The puparium is usually found just beneath the soil surrounding the plants, but sometimes pupation takes place within the leaf-blister. There are successive broods of flies through the summer, and the ravages of the maggots are sometimes found to recur every three or four weeks. The winter is passed by the insect as a buried pupa.

The Mangold-fly, like the flies that give rise to the Cabbage-root maggots, belongs to the family Anthomyiidæ. Its genus Pegomyia agrees with Phorbia, the genus of the Cabbage-flies, in the equality of the two rounded scales at the wing-base, but differs

in that most of its species have the legs largely yellowish, instead of black. *Pegomyia betæ* measures about 5 mm. in length, and 12 mm. across the outspread wings. The female (fig. 8) is an ashy-grey fly with very indistinct longitudinal stripes on the fore-body, and a reddish frontal marking on the head between the eyes. The thighs and shins are yellow, dusky along their outer edges, and the feet are black. In the male the eyes are much larger than in the female, almost meeting in the middle of the head (fig. 9); the body is darker grey, and the thighs are altogether dusky, the shins only being partially yellowish. See Meade (6).

The concealed feeding-habit of these maggots makes it useless to apply any insecticide for their destruction. A certain method of killing the maggots is to remove and burn all the injured leaves; but probably no farmer would undertake such a task over a large field. The usual practice is to apply some stimulating manure, and to wait for heavy rain, which is generally found to check effectually the ravages of the fly. It is often noticed that the large outer leaves of the Mangold-plants suffer badly from the maggots, while the smaller inner leaves remain comparatively uninjured; and, as a rule, it is only when the attack begins early, affecting the young foliage, just after sprouting, that the roots become seriously reduced below their normal size. Such was the experience of Mr. T. A. Rudd, Agricultural Instructor in West Cork, who informs me that the crop was disastrously injured in cases where the attack began early under conditions favourable to the flies.

Crane-Fly.

Tipula oleracea, Linn.

An exceptional case of injury to Mangold-roots by the Leather-jacket grubs (see p. 281) at Enniscorthy, County Wexford, was brought to my notice in June by the editor of the *Farmers' Gazette*. The correspondent stated that these grubs were also injuring roots of Vegetable Marrow plants.

PEA AND BEAN INSECTS, &c.

The Pea-Beetle.

Bruchus pisi (Linn.).

Peas containing pupæ and adults of this well-known insect were kindly sent to me from County Limerick, in December, by Mr. J. O'B. Croke. Beetles of the family Bruchidæ are easily recognised by the feet with four segments, and the head (largely covered by the fore-body shield) bearing short feelers and not prolonged into the snout which is so characteristic of the true weevils (Curculionidæ). *Bruchus pisi* measures 4–5 mm. in length, and is of a black colour, variegated with greyish down, the thighs and feet of the front legs and the feet of the middle legs being red. The hard, case-like forewings (elytra) are ornamented with patches of white, downy hairs, arranged in a wavy, transverse series, while the tail-end of the abdomen is covered with white hairs, so arranged as to leave two conspicuous, rounded, black patches (fig. 3, *e*).

Full accounts of this beetle and the allied forms which attack Beans will be found in the writings of Ormerod (9, 1900, pp. 21–31) and Riley and Howard (10). The beetles are active in early summer when the peas are blooming, and the female lays her eggs on the surface of the young pod. The egg (fig. 3, *a*) is spindle-shaped, deep yellow in colour, 1·5 mm. long, and attached by means of a sticky fluid which turns white on drying. From this is hatched the stout, hairy larva (fig. 3, *b*) with three pairs of short legs, and powerful complex spines on the foremost trunk-segment. It is believed that these spines enable the grub to bore through the pod into a young pea. Usually the grub makes its way directly through into the pea, but occasionally it lives for a time mining in the pod before entering the pea. Having entered the pea, the grub casts its skin and becomes a legless, fleshy maggot (fig. 3, *c*) with very small head. It now proceeds to tunnel in the substance of the cotyledons, often injuring the plumule so as to render germination impossible, and always damaging the seed sufficiently to check healthy growth. These facts are of

great practical importance, as dealers sometimes assert that "weevilled" peas and beans germinate as well as uninjured seeds! By autumn the grub is fully grown, and its last act before pupation is to cut a circular passage to the outer skin (testa) of the seed, thus providing a way of escape for the beetle, which, when developed, has only to bite through the circular drum-like membrane left by the grub. This spot is visible as a dark patch on "weevilled" seeds, and Mr. Croke points out to me that it can be rendered more easily visible by soaking. The beetles emerge from the pupa-skins in late autumn or winter; but they remain within the seed till the spring, when they come out to lay their eggs on the new crop of peas or beans.

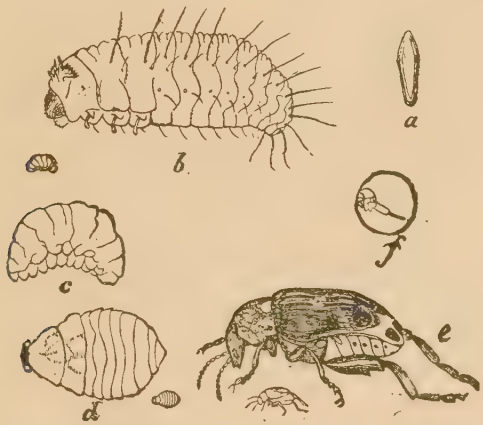

Fig. 3.—Pea Beetle [*Bruchus pisi* (Linn.)]. (*a*) egg; (*b*) young larva: both highly magnified; (*c*) older larva; (*d*) pupa; (*e*) Beetle: × 5; (*f*) injured pea, natural size. From Riley and Howard (partly after Curtis). "Insect Life," U. S. D. Ag., vols. iv., v.

The sure remedy for this infestation is a rigorous refusal to accept or sow "weevilled" seed. Those who use such seed not only get a short and feeble crop, but secure another generation of beetles to damage their own and their neighbours' plants.

Springtails.

Lipura ambulans (Linn.).

Further confirmation has been received of the injurious action of the Springtails mentioned in my paper of last year (3, 1903,

pp. 251–3). In June I had the opportunity of examining in a County Dublin garden roots of Kidney Beans badly gnawed by Lipuræ, accompanied by a few specimens of Achorutes. The appearance of roots injured by these Springtails, and the characteristically scraped surface, can be seen in the photograph (Plate XXVI., A).

A New Oribatid Mite.

Lohmannia insignis, Berlese.

Plate XXV.

Associated with the Springtails just mentioned were specimens of a brown mite which was also devouring the root-surfaces. Mr. Cecil Warburton, to whom specimens were shown, recognised the creature as an Oribatid, new to science. Meanwhile, Signor A. Berlese, to whom examples from another locality had been unknowingly sent several months previously along with some Gamasidæ, described and figured the animal as *Lohmannia insignis* (1, pp. 23-4). The genus Lohmannia, Michael (8), is characterised by the cylindrical form of the abdomen, the short, stout legs, each with a single claw, the four foremost and four hindermost being inserted, respectively, close together, and the large chelate mandibles. The dorsal plate of the abdomen is flexed far round on the ventral surface, where it touches the lateral "cover" bounding the anal and genital areas (Plate XXV., figs. 1, 2).

The mites of this genus are lightish-brown in colour, and are remarkable in resembling in aspect the immature (nymph) forms of the more typical Oribatidæ. There are but very few known species of Lohmannia. Michael (8) mentions only two, one German, and the other Italian; a few additional Italian species have since been described by Berlese. Until the discovery of the present mite, the genus was not represented in the British Islands. The observation of Mr. Bell, the gardener who first directed our attention to the mite, is therefore of faunistic as well as of economic importance.

Lohmannia insignis may be distinguished from the other species of the genus by its general form, by the simple bristles on the abdomen, and by the peculiar feathered pseudostigmatic organs

(Plate XXV., figs. 1, 4). These structures protruding from the paired tubular or cup-shaped outgrowths—formerly regarded as the entrances to the air-tube system—on the fore-body of the mite are specially characteristic of the Oribatidæ.

It is of considerable interest to find a small animal like this, hitherto unknown to naturalists, forcing itself on our attention by damaging cultivated plants. All the Oribatidæ are vegetable-feeders, but most of them are found among moss, or in partially decaying wood; and I know of no record of any species being injurious in farm or garden. The most reasonable suggestion seems to be that the presence of an abundant supply of vegetable food in the neighbourhood of a small colony of mites induced them to change their method of feeding, and led to a great increase in their numbers.

POTATO INSECTS.

Small Chafer.

Phyllopertha horticola (Linn.).

Grubs of this well-known beetle were sent in July from Waterford by the County Agricultural Instructor, Mr. J. Johnston, who stated that they were very numerous in the soil around Potato plants suffering from a fungal disease. It is to be presumed that these grubs were devouring the tubers and roots; but it is, I believe, unusual for them to attack Potato.

Spotted Millipede.

Blaniulus venustus, Meinert.

Potato tubers were sent me from Kilkenny in March by Mr. F. W. Moore, of the Royal Botanic Gardens, badly gnawed and tunnelled by small Snake-millipedes of the genus Blaniulus. These Millipedes are easily recognised by their narrow, elongate cylindrical form and their pale-whitish colour, adorned with red spots arranged in series along either side. They are often highly injurious to Potatoes. According to Theobald (15, p. 86), a dressing of lime to land infested with them is the surest remedy, and the plan of dusting soot and lime around each tuber when set has been tried successfully as a means for preventing their attacks.

GARDEN INSECTS.

The Celery-Fly.

Acidia heraclei (Linn.).

During the autumn months of 1904—from September till November—many complaints were received of the damage done by the leaf-mining maggots of this fly to Celery grown in County Dublin gardens.

The fly is included in the same large family of the two-winged flies (Diptera) as the Gout-fly (*Chlorops tæniopus*) already described in this paper. It belongs, however, to a section of the family characterised by a variegated dark pattern on the wings, which in this species are mostly mottled with deep brown, leaving a few transparent spots and patches. The fly is about 6 mm. ($\frac{1}{4}$ inch) long, and of a dark brown or blackish hue, the front of the head and the legs being yellow (fig. 4, *a*). The insect is first on the wing in May, and the female lays her eggs on the leaves of Celery and Parsnip (as well as on many wild plants, such as Cow-parsnip and Dock). The maggot, fleshy and white, or often greenish (because the food shows through the transparent skin), lives, like the maggot of the Mangold-fly, between the two leaf-skins, eating away the soft, green tissue. Its presence is at first shown by a small, round blister paler than the rest of the leaf. As the maggot feeds, moves, and grows, the blister spreads, becoming first white, and then, as the leaf dries up, brown, and choked with the insect's black excrement. Several maggots often feed on one leaf, which may at last wither completely.

Several broods of maggots succeed each other through the summer and autumn. The pupal stage may be passed within the leaf, but more often underground; the puparium (fig. 4, *c*) is very distinctly segmented with deep constrictions between the segments, yellow or light-brown in colour. The latest autumn brood of maggots always bury themselves a few inches deep in the soil for pupation, and the flies from these do not appear till the following spring.

From this fact it is evident that the removal and deep burial of the surface-soil in winter after an attack, or a dressing of

gas-lime dug in, would be effectual in preventing a return of the mischief in the ensuing year. In garden cultivation it should be quite practicable to kill the maggots as they feed within the leaves by pinching the blisters, and a watch should be kept for their first appearance. At a later stage the blistered leaves may be hand-picked and burnt; on no account should they be left lying about, as the insect is very hardy, and the maggots often complete their transformations even though the leaves be removed from the plant.

Fig. 4.—(*a*) Celery-Fly (*Acidia heraclei*). (*b*) puparium; (*c*) maggot: all × 3; (*d*) blistered leaf: natural size.

Enchytræid Worms.

Enchytræus parvulus, Friend.

In my paper on Insects observed during 1902 (3, 1902, pp. 202–3), reference was made to the damage done to Celery and other garden plants by these small, white Annelids. In February, 1904, complaint was received of serious injury by them to Celery in County Sligo, and the application of a heavy dressing of salt, found effectual in Dublin, was recommended.

Specimens of these worms were received in November, 1904, sent from Belfast by my friend, Mr. W. H. Patterson, who had

found them at the roots of grass on a lawn that turned brown in circular patches. More abundant, however—probably the main cause of the damage—were small, white Springtails.

Springtails.

Lipura ambulans (Linn.).

As just mentioned, these little insects, described and figured in my last paper (3, 1903, pp. 251–3, fig. 3), were exceedingly numerous in a Belfast garden, doing much harm to Cabbage and other vegetable roots. Mr. Patterson kindly informs me that he has succeeded in clearing the soil of them to a great extent by applying gas-lime to the amount of about six tons to the acre.

Similar complaints reached me from Mr. J. W. Warburton, of Rostrevor. He wrote in May, forwarding specimens of *Lipura ambulans*, and stating that he found the insects most destructive to bulbs, Cabbage, Cauliflower, and other vegetables, and various flower roots. Applications of lime with soot were found to keep them in check, but only partially. Mr. Warburton tells me that he finds the Springtails constantly attacking perfectly sound bulbs and roots, thus affording further evidence of the destructive *rôle* now played by these small, frail insects, whose power for mischief depends on their rate of multiplication, and their consequently large numbers.

Root Mites.

Rhizoglyphus echinopus (Furn. & Rob.).

Reference was made to these destructive mites in my paper of last year (3, 1903, pp. 258–260, fig. 6). Specimens of Daffodil bulbs destroyed by them were received in August from Mr. J. Bell, of Tibradden, Co. Dublin.

ORCHARD INSECTS.

The Vapourer Moth.

Orgyia antiqua (Linn.).

Caterpillars of this familiar moth were received in August from County Leitrim, where they had done some damage to the foliage of young Apple-trees which had been planted in the spring after importation from France. This moth has a wingless female,

laying her eggs in the autumn on the cocoon from which she has emerged, and they remain unhatched till the following spring. We must conclude, therefore, either that eggs of the insect were imported with the trees, or that the caterpillars migrated to the trees from some neighbouring feeding-ground. They devour greedily plants of many different kinds, notably Rosaceæ, and are very active in their habits.

The Small Ermine Moth.

Hyponomeuta padellus (Fab.).

Damage to the foliage of Apple-trees, at Glasnevin, by the web-spinning caterpillars of this well-known moth was reported by Mr. F. W. Moore in June.

The Pear Midge.

Diplosis pyrivora, Riley.

In June I received, from Dr. G. H. Pethybridge, young Pears infested with the maggots of this destructive midge. They had been obtained by Mr. Magill, Horticultural Instructor, from an orchard in County Tyrone, where the trees, about fifteen years old, are said to be much too thickly planted. Specimens were also found numerously in an orchard close to Dublin. So far as I know this midge has not been previously recorded in Ireland, and it deserves, therefore, some detailed notice, as it is of importance that owners of orchards should be on their guard against it. The life-history has been fully described in this country by Meade (7), and Ormerod (9, 1896, 1898), and in America by Smith (12).

The insect belongs to the family of Cecidomyiidæ or Gall-midges, which are recognisable by their minute size, elongate feelers, simple wing-neuration, and the elongation of the terminal segments of the female's hind-body to form a tubular ovipositor. According to Meade's description, *Diplosis pyrivora* is about 2 mm. ($\frac{1}{12}$ inch) in length, with the head and fore-body black, with greyish reflections, and the hind-body dark brown with whitish hairs. There are patches of yellow hairs on the head and above the wing-bases, and the feelers are yellowish-brown (fig. 5, 1). The female

midges appear in spring when the pears are in blossom, and lay their eggs in clusters of six to eight, or more, in the blossoms. Smith states that the female inserts her ovipositor into the bud wherever she can do so most easily, and that the eggs, covered by a membranous adhesive material, may be found in any part of the blossom. From these eggs are hatched out the small, yellow or orange maggots which eat their way into the young, developing fruit. The maggot of a Gall-midge may be recognised by the peculiar, hard, chitinous, "anchor-process," or "breast-bone," situated on the ventral surface between the prothorax and the hinder segment of the head, which in these maggots is distinct from the very small head-capsule (fig. 5, 2). The anchor-process of

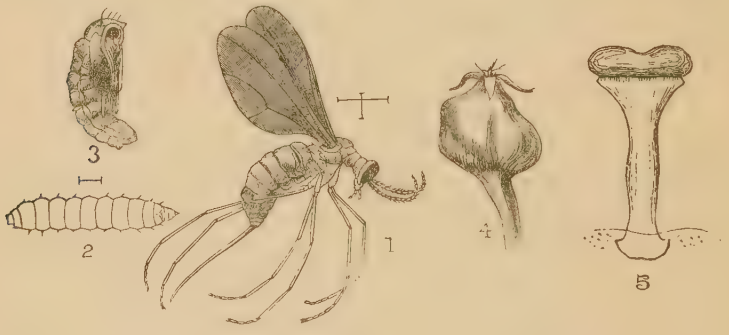

Fig. 5.—1. Female Pear-Midge (*Diplosis pyrivora*). 2. Maggot. 3. Pupa (magnified). 4. Stunted Pear (natural size). From Ormerod, after Riley. 5. Anchor-process: × 80.

D. pyrivora is very elongate and slender, broadened suddenly at its distal (forward) end (fig. 5, 5). As forty or fifty maggots may be found in a single pear, it is likely that several midges lay their eggs in a single blossom. The maggots feed on the tissue of the young fruit around the seed capsules, and the result of their presence is that when the pears are from ½ inch to 1 inch long they stop growing. By the middle of June the maggots have attained their full length of 4 mm. (⅙ inch); the fruits they inhabit can usually be easily recognised by their distorted, stunted appearance (fig. 5, 4), the inside becoming black and decayed. The infested pears crack open, and often fall from the tree. In any case the

maggots, which are very active, and able to leap, by means of the successive folding and straightening of their bodies, wriggle out and alight on the ground. Then they bury themselves an inch or two deep in the soil, and remain resting until autumn, after which they surround themselves with their silken cocoons with grains of sand attached. In spring the larval skin is cast, and the pupa (fig. 5, 3) revealed, whence the midge soon emerges to lay her eggs on the blossoms.

As Smith points out, the concealed feeding habit of the maggots within the pears renders any kind of spraying useless. But the fact that there is only one life-cycle in the year, and that from midsummer until spring, all the insects are buried an inch or so in the soil beneath the trees, either in the larval or pupal stage, affords a sure means for preventing the recurrence of the attack. Smith has shown that a heavy top-dressing of kainit, applied in late summer or autumn, acts most effectually in killing the maggots. Needless to say, infested pears should be collected and rigorously destroyed.

The Apple-Plant Louse.

Aphis pomi, De Greer.

Complaints of damage to old Apple-trees by this well-known pest were received in July from County Tyrone. Its life-history has lately been worked out in detail by Smith (13), who lays stress on the fact that the young Aphids, first appearing in spring, are hatched from the winter eggs within a fortnight of the first appearance of the foliage; spraying with paraffin or tobacco emulsion at this period is therefore of especial importance. Theobald, however, who has recently shown us how to distinguish this species from other Aphids of the Apple (16, pp. 22–33), insists that autumnal spraying, so as to kill the sexual females before they can lay their eggs, is of much greater value.

The Black-Currant Mite.

Eriophyes ribis (Westwood).

Complaints of damage due to this mite, described and figured in my last paper (3, 1903, pp. 260–262, fig. 7), continue to be

received from various parts of the country. The Rev. C. H. Waddell informed me, for example, that out of a plot of twenty bushes in a County Down garden, half had been destroyed.

FOREST INSECTS.

The Green Bell-moth.

Tortrix viridana, Linn.

At midsummer, I learned from Mr. Thos. Acton, of Kilmacurragh, Rathdrum, that the oak-woods in the Vale of Avoca, County Wicklow, were suffering severely from the ravages of the well-known green leaf-rolling caterpillars of this moth. From a few branches kindly sent by Mr. Acton, I reared over a hundred moths. The dried-up appearance of the foliage during the height of this attack made the woods look as if scorched by fire.

OSIER INSECTS.

Willow-bud Gall-midge.

Rhabdophaga heterobia (Loew).

In the winter of 1903–4, I received information from Mr. R. H. Prior-Wandesforde, of Castlecomer House, County Kilkenny, of serious injury caused to Osiers by the maggots of a Gall-midge; and during the summer he kindly sent me fresh specimens of the galls, with the maggots living socially within them. The Abbé Kieffer has kindly identified the species as *Rhabdophaga heterobia*, Loew, a species well known on various species of *Salix*, but not, I believe, hitherto recognised as injurious to Osiers.

The midge is a minute, hairy, black insect (fig. 6, *a*). The ovipositor of the female is shorter than in *Diplosis pyrivora*, and the wings show a very markedly obtuse angle at the forking of the third nervure.

The maggots live, six or eight together, in the buds of the Osiers. Their presence there causes the leaves to become stunted and twisted, and covered with a dense, white, woolly growth, which serves as a shelter for the insects (Plate XXVI., B). The gall has been figured by Kieffer (5). The buds being thus arrested in their

growth, no new shoots are formed, and the damage done to Osiers grown for industrial purposes becomes serious. Mr. Prior-Wandesforde informs me that the insects "confined their attack almost entirely to the dark-skinned variety of Osier which we call

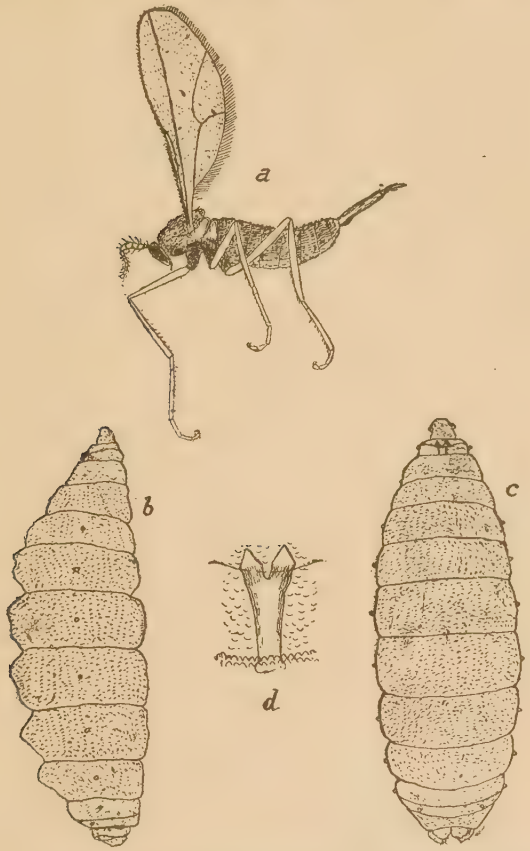

Fig. 6.—Osier Gall-Midge (*Rhabdophaga heterobia*, Loew). (*a*) Female, side view; (*b*) Maggot, side view; (*c*) Maggot, ventral view: × 50; (*d*) Anchor-process: × 150.

the 'Norfolk,' and which is about the best we have for yielding light, clean, hard rods for the better class of basket-work; all these Osiers were destroyed, but the greener varieties of Osier, more suitable for growing big, heavy rods and sticks, such as

'Spaniards,' 'Black-tops,' 'Black-mauls,' were very little attacked, and in some cases of 'Spaniards,' where there was an odd plant put by mistake among the 'Norfolks,' the 'Spaniard' was untouched, and the 'Norfolks' covered with grubs."

The grub is about 1 mm. long, thicker in proportion than the maggot of *Diplosis pyrivora*, and of a bright orange colour; the skin is covered with numerous small, blunt denticles. The anchor-process (fig. 6, *d*) is comparatively short and deeply bifid distally. The process, as figured by Rübsaamen (11, plate xviii., fig. 10), has a broader base than in my specimens; but its general form agrees with what I have observed, and there is doubtless a considerable amount of variation in such matters of detail within specific limits. These grubs do not go underground, but pupate within the galls. My friend Dr. R. Stewart Macdougall has confirmed this by keeping the galls over the winter, and rearing midges in the succeeding spring. From this it appears that cutting and burning the infested shoots should prevent a recurrence of the attack. Mr. Prior-Wandesforde tells me, however, that the Osiers were injured badly both in 1903 and 1904, though the galled shoots had been burned in 1902 and 1903. Possibly the parents of the new generation made their way to the Osier-beds from neighbouring Willow-trees.

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EXPLANATION OF PLATE XXIII.

PLATE XXIII.

Fig.

1. Portion of Mangold leaf, showing cluster of eggs of *Pegomyia betæ*, with burrows formed by maggots: × 7.

2. Two eggs of *P. betæ*, one showing external sculpture, the other the maggot surrounded by embryonic membrane within: × 35.

3. Newly hatched maggot: × 12; 3 *a*, mouth hooks: × 75; 3 *b*, tail end of maggot: × 30; 3 *c*, a tail spiracle: × 75.

4. Maggot, second stage: × 12; 3 *a*, mouth hooks: × 54; 3 *b*, tail end of maggot: × 30; 3 *c*, a tail spiracle: × 75.

5. Maggot, later stage: × 7; 5 *a*, mouth hooks: × 35; 5 *b*, prothoracic spiracle: × 130.

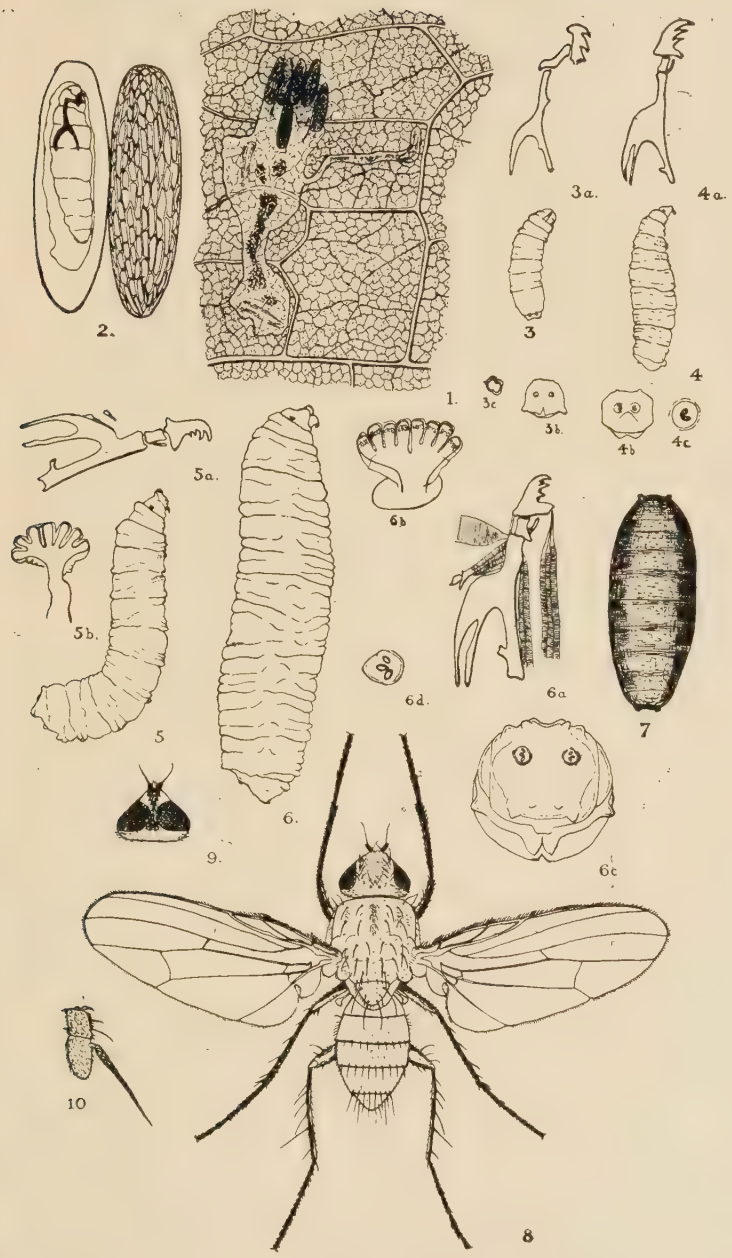
6. Maggot, full-grown: × 7; 6 *a*, mouth hooks: × 35; 6 *b*, prothoracic spiracle: × 130; 6 *c*, tail end of maggot: × 14; 6 *d*, a tail spiracle: × 45.

7. Puparium: × 7.

8. Female Mangold fly (*Pegomyia betæ*): × 7.

9. Head of Male Fly: × 7.

10. Feeler of Male Fly: × 30.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EXPLANATION OF PLATE XXIV.

PLATE XXIV.

Mangold Plants, with outer leaves mined by maggots of *Pegomyia betæ*.

[From a photograph by W. A. Murphy.]

EXPLANATION OF PLATE XXV.

PLATE XXV.

Fig.

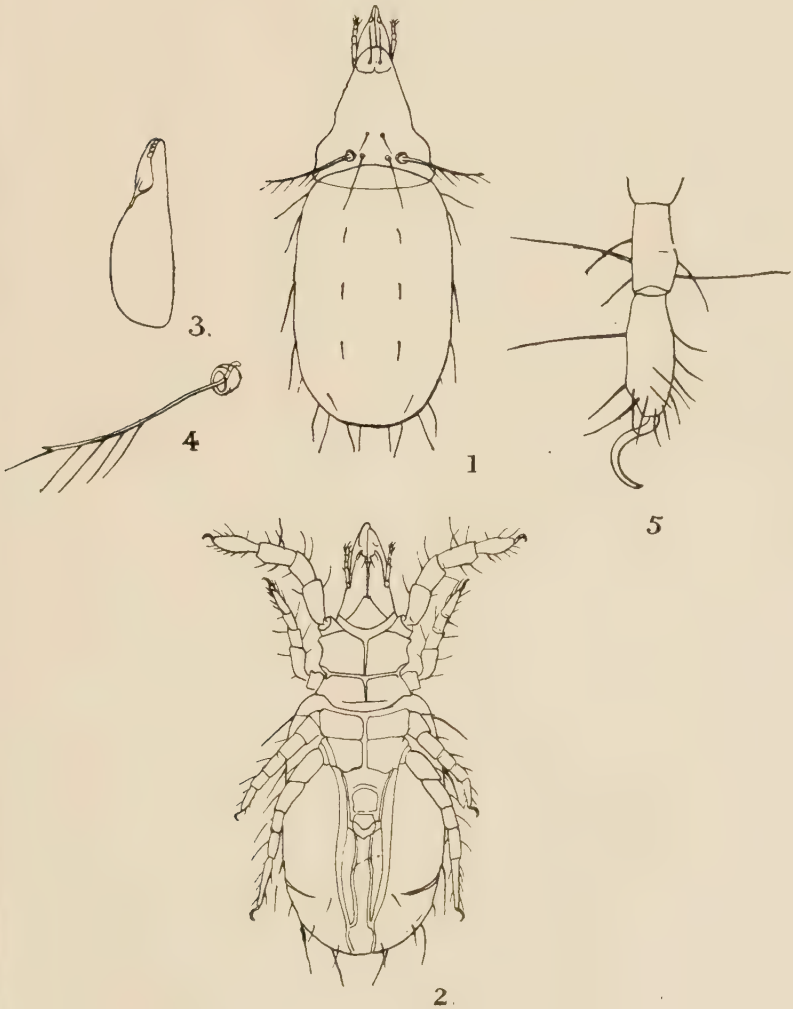
1. Oribatid Mite (*Lohmannia insignis*, Berlese), dorsal view; legs removed: × 45.

2. The same, ventral view: × 45.

3. The same, chelicera: × 120.

4. The same, left pseudostigmatic organ: × 120.

5. The same, terminal segments of forefoot: × 120.



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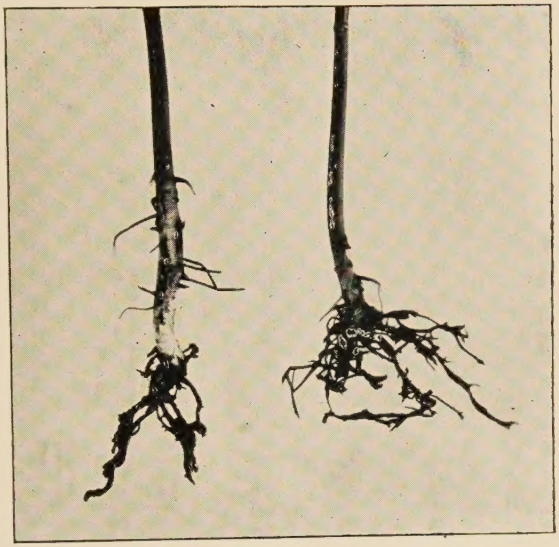
EXPLANATION OF PLATE XXVI.

PLATE XXVI.

A. Roots with surface gnawed by Springtails (*Lipura*) and Oribatid mites (*Lohmannia insignis*).

B. Buds of Osier galled by Maggots of *Rhabdophaga heterobia* (Loew).

[From photographs by T. Price.]



A.

B.